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Edited by
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The Effect of the Recent Sugar Agreement with Britain on Queensland Sugar Cane Agriculture.*

By NORMAN J. KING.

A SHORT twenty-five years ago Queensland produced its first appreciable sugar surplus and exported 74,000 tons of sugar after all Australian requirements had been met. By 1933 the surplus had grown to 305,000 tons but during the same period of nine years the overseas price had shrunk from £21 to £8 per ton—the £8 being much below local cost of production. This state of affairs ushered in a period of restriction which was devised to retard the accelerating production and thus to maintain an economic price for the producer. However, technical progress in the industry resulted in the exportable surplus reaching 516,000 tons in 1939 after which time the impact of the war years brought about a considerable reduction. Record production levels have been attained during the past two years but the tonnage exported is less than in 1939 owing to the increased Australian population and to the rise in *per capita* consumption.

It will be appreciated that, when in a year of record production the exportable surplus was only 440,000 tons, any considerable increase above that figure could be the result only of large scale expansion of acreage under sugar cane. The time would appear to have arrived when this expansion is imminent.

One of the most important and far reaching events affecting the Queensland sugar industry within the past quarter century was the recent agreement with the British Government for an increased export quota. By 1953 Australia will be expected to send to Britain 600,000 tons of sugar—a figure which is 160,000 tons in excess of the 1948 season's export. This bald statement does not convey any suggestion of the magnitude of the task facing our sugar producers.

During previous periods of expansion it was the usual practice to open up new areas of good land, but, as in most other agricultural areas, the most fertile and most strategically situated districts were selected first, and the acreage of suitable country remaining for subdivision is limited. Let us pause to consider what this 160,000 tons

* An A.B.C. address.

of sugar will involve in terms of extra acreage. In 1948 the average production of sugar per acre in Queensland was 3.52 tons. On this basis a further 45,454 acres would be required. But we cannot expect always to experience such bounteous seasons and it is more reasonable to base any calculations on a lower average of, say, 3.0 tons of sugar. The requirements would thus be a further 53,000 acres for annual harvest or 71,000 acres of extra cultivation so as to provide for land rotation.

Such an area of highly fertile and accessible land may be difficult to locate in the climatic zone suitable for sugar cane growing.

The industry must therefore look for part of its acreage requirement in less fertile areas and also exploit the potentialities of recently produced improved cane varieties. The utilization of less fertile tracts will increase the acreage required and will, at the same time, make a greater demand on fertilizer.

At the present time the Queensland sugar industry is the largest user of potash and sulphate of ammonia in Australia and also absorbs very large quantities of super-phosphate. The extra sugar quota will require a further 8,000 tons of sulphate of ammonia and considerable amounts of the other fertilizers.

The clearing of such a large acreage of land, most of which is at present covered by thick jungle or forest growth, will call for an extensive labour and machinery pool, and the extra tractors and implements required for its cultivation will cause a heavy drain on the already strained resources of manufacturers. To harvest the extra crop a further 1,500 cane cutters will be required.

An increased income to the industry will be a natural accompaniment of the expansion scheme. The 1948 sugar crop was worth over twenty three million pounds to the growers and millers, and further considerable sums were distributed to refiners, wholesalers and retailers. Based on 1948 export rates a further 160,000 tons of sugar will return an extra four and a-half million pounds but export sugar values are likely to fluctuate from year to year and the above figure may not be maintained if world sugar surpluses develop.

At the same time we must not lose sight of the fact that Australian consumption of sugar is increasing at an appreciable rate and that the immigration policy of this country promises a steadily increasing population of consumers. During the past ten years the average annual increase in home consumption of sugar has been 12,000 tons, so that ten years hence we might conservatively estimate a requirement of a further 120,000 tons for the home market. This would be over and above the figure covered by the British agreement.

Taken together, the commitment of an increased export quota, and the responsibility of the idustry to produce all Australia's requirements in the future, present a big task but one that we must find ways and means to achieve. The sugar idustry has in the past leant heavily on its agricultural research organization, and future expansion will call for even greater dependence on scientific workers. The exploitation of marginal lands will call for agronomic research and advice of a high order, the maintenance of soil fertility levels will be of greater importance, and the extended harvesting seasons brought about by large crops will accentuate the already serious problem of early

maturing and late harvesting varieties. Much of the future prosperity of the industry, as well as its capacity to fulfil home and overseas commitments, will depend on the ability of our plant breeders to solve the variety problems.

Much of the past progress of the industry has been the direct result of intelligent use of better yielding cane varieties and of types which were resistant to our major cane diseases. The Queensland industry, besides taking advantage of the best varieties from other countries, has through the cane breeding programme of its own geneticists, produced types which are far better producers than their predecessors. This work, the most important phase of our agricultural research, will continue at an increased tempo.

The Bureau of Sugar Experiment Stations has, for some years, been concentrating on this phase of sugar cane production work and is planning, at the present time, an expedition to New Guinea to search for cane varieties. It is felt that the potentialities of this habitat of both wild and noble canes have not yet been fully exploited and that much of value to our industry may be unearthed. Breeding for early maturity is made more difficult by the fact that most of our existing early maturers do not flower freely and cross-pollination is therefore not practicable each season. A supply of free flowering, early maturing parents from New Guinea would be of incalculable value in assisting the expansion programme.

The future therefore will be one of concentrated effort by the technicians of the industry, both in field and mill; it will require concerted efforts by producers and by sugar factories, and many problems of supply will have to be overcome by machinery manufacturers, fertilizer companies and tractor firms.

A NEW PATHOLOGY PLOT.

In past years most of the pathological investigational work has been carried out in a small plot at the Brisbane Domain. In addition, disease resistance trials have been conducted in isolated plots worked from established Bureau centres in various parts of the State. However, an increase in research work, brought about largely by the need for immediate work on the ratoon-stunting disease requires a larger area than is available at the Domain, and in addition the eradication and improved control of certain of the major sugar-cane diseases has made it undesirable to carry out disease resistance trials adjacent to commercial cane lands.

For these two reasons the Advisory Board some time ago approved a scheme to obtain an area of land near Brisbane where all the pathological work, apart from that which has to be done in a glasshouse, could be brought together. It was fortunate that the Bureau was able to obtain a cleared area of ten acres with five acres cultivated on ground belonging to the Queensland University at Moggill. The soil is very suitable for cane growing and irrigation water is laid on. The plot is well isolated from commercial cane and the site itself is hemmed in by timber and ridges which should give the humidity and warmth necessary to allow the spread of certain diseases and the rapid growth of cane.

C.G.H.

The Use of Pre-emergence and Contact Sprays for Weed Control.

By L. G. Vallance.

INTRODUCTION.

THE possibility of using chemical sprays for the control of weeds and grasses has aroused a great deal of interest in many of our cane-growing districts. Such methods have been successfully used in several overseas sugar producing areas particularly in Hawaii and Louisiana. However not a little of the success achieved in these two countries is due to the low cost at which the materials may be purchased and, furthermore, big plantations are able to utilise expensive power spraying equipment economically because of the large acreage involved. Nevertheless it appears very likely that these chemicals will ultimately be used to a considerable extent in many Queensland canefields.

During the spring of last year an extensive series of trials was put down to investigate the efficiency of 2-4D as a pre-emergence spray under Queensland conditions in conjunction with various contact weedicides. These were located at Meringa, Innisfail, Mackay, Bundaberg and the Maroochy district.

GENERAL PROCEDURE OF TRIALS.

In all these trials two fundamental principles were adopted. These were:—

(1) *Pre-emergence Spraying.*—This involved the appplication of 2-4D dissolved in water and sprayed on the soil when it was bare and free from weeds just after planting or ratooning. When applied in this way 2-4D has the power of killing both grass and weeds immediately the seeds germinate. This is a particularly valuable characteristic since this substance is ineffective on grasses once the seedlings are growing. It is necessary therefore to apply the 2-4D before the seedlings emerge from the soil, hence the term "pre-emergence control." Two different rates of 2-4D were used, namely, $2\frac{1}{2}$ lb. and 4 lb. per acre. The amount of water used to dissolve these quantities of chemicals varied from approximately 20 gallons to 60 gallons per acre.

(2) *Contact Spraying.*—The purpose of this treatment was to control the weeds and grasses which appeared when the effectiveness of the initial pre-emergence spray wore off. It consisted of a base such as diesel oil, tar oil or creosote plus sodium pentachlorphenate. This latter chemical has considerable weed-killing properties. In addition a quantity of 2-4D was added, not only to increase the weedicidal power of the spray, but also to give a further pre-emergence effect.

Briefly, the principle adopted was to apply 2-4D to clean soil in order to stop the development of weed and grass seeds. When this began to lose its effectiveness the contact spray was applied to kill the weeds which were starting to grow. The inclusion of 2-4D in the contact spray provided further pre-emergence control.

PRE-EMERGENCE SPRAYING.

Methods of Applying the Pre-emergence Spray.

In the majority of the experiments the pre-emergence spray was applied using an ordinary knapsack type of spray. This gave good

FIG. 1.—Innisfail. Showing good control of weeds 21 weeks after spraying with 2–4D. The row on the left was not sprayed.

coverage and proved to be a satisfactory and efficient method of application. However, as might be expected it was not a very rapid method and under normal farm conditions labour costs would be high in relation to weed control by tractor drawn cultivating implements.

Because of the necessity to reduce labour costs a boom spray was fitted to a Farmall tractor and operated with very good results on Bundaberg Experiment Station. This equipment, together with details regarding its use is fully described by Knust in an accompanying article in this issue of the Quarterly Bulletin. A simpler type of power spray which could probably be adopted for use in cane is one which has been used for spraying potatoes in the Boonah district. A description of this machine is also given elsewhere in this Bulletin.

FIG. 2.—Innisfail. Showing the control of weeds 20 weeks after the initial spraying. This row received two applications of 2–4D. The portion of the row in the background was not sprayed.

Results of Trials.

At Meringa, Innisfail and Bundaberg very good results were obtained from the pre-emergence sprays. The results obtained on the Meringa Experiment Station indicated that one application of 2-4D applied at the rate of 4 lb. per acre early in September gave sufficient control of weeds and grasses for all practical purposes until the end of January. At that date the cane was nearly out of hand and no other

treatment was necessary. Prolific weed and grass growth occurred in the unsprayed adjacent check rows. The control given by the use of only 2½ lb. of 2-4D per acre was not quite satisfactory. However, the plots receiving this light application had much less weed growth through the rainy season than is normally present on many farms during this period, when wet conditions prevent cultivation. Good results were obtained on both plant and ratoon cane.

At Innisfail two plant and two ratoon cane plots were treated with 2-4D at the rate of 4 lb. per acre. This application gave a satisfactory control of weeds and grasses from late September until February, covering a period of 21 weeks without any other treatment being necessary. The results of this trial are shown in the accompanying photograph (Fig. 1).

Other plots in this area were given a second spraying in November, consisting of a further 4 lb. of 2-4D per acre plus diesel oil and sodium pentachlorphenate. However from the indications of the plots which received only the initial spray in September it would appear that the second spraying was not necessary. The complete absence of weeds and grasses in the sprayed area is shown in Figure 2. The photograph was taken in February about twenty weeks after the first spraying in September. In these trials it was also shown that 2-4D prevented the emergence of Sensitive Weed and Rattlepod. However it did not prevent the germination and growth of Mauritius Bean.

The same series of trials was put down at Mackay with disappointing results. The failure was due to two reasons. Firstly the land was badly infested with nut grass over which the 2-4D exercised no pre-emergence control. Secondly the soil cracked very badly and grasses and weeds grew from out of these cracks. Furthermore the fact that it was not possible to cultivate the soil after the spray had been applied led to a depression in growth of the cane, since cultivation is essential on this type of soil.

As in North Queensland good results were obtained with the use of 2-4D as a pre-emergence spray on the Bundaberg Experiment Station. On one particular block (B.3) complete control of weeds and grass during spring and summer was obtained by an application of 2½ lb. of 2-4D per acre on 21st September followed by a similar application in December. Two other blocks were sprayed with 2-4D at 4 lb. per acre on 23rd November (Block E.3a) and 16th December (Block B.1). These required no further treatment since complete control of weeds and grass was obtained until the cane was out of hand in February. Although single applications of 2½ lb. per acre were also tried the results were not as satisfactory as the 4 lb. treatment.

These results must be regarded as very encouraging since the trials were subjected to a considerable amount of rain in January and February. In North Queensland also the heavy rains experienced during these two months seemed to have little or no influence on the effectiveness of 2-4D. However at Bundaberg it was noticed that where pools of water lay in the inter-row space for some time weeds and grasses subsequently germinated and grew. On the red volcanic soils of Bundaberg Station a considerable amount of experimentation and experience has shown that inter-row cultivation is unnecessary except to control weed and grass growth. Therefore the fact that the soil could not be disturbed after the spray had been applied did not matter. In this respect the conditions were different from those previously mentioned at Mackay.

In the Maroochy area trials were also set out on both plant and ratoon cane. The sprays were applied during late October and early November using 2½ lb. and 4 lb. of 2-4D per acre. Reasonably satisfactory pre-emergence control was obtained by the heavier application. However, as at Mackay, the trials were failures because the cracking of these somewhat heavy soils allowed the germination of weeds and grasses. Nevertheless, indications were obtained on some of the trial areas of lighter and sandier soil that a pre-emergence control was being obtained. This promise was sufficiently encouraging to continue the trials. It would appear to be advantageous to apply the spray later in the season.

Difficulties and Disadvantages.

There are certain difficulties and disadvantages associated with the use of the pre-emergence sprays which may prevent the general use of such methods for weed control. In the first place cost is an all-important factor.. At the present moment the price of 2-4D apparently varies from eleven to twenty shillings per lb., depending upon where it is purchased. At the lower price quoted pre-emergence spraying is probably an economic proposition if a tractor spray is used. In certain districts knapsack spraying in the cane row and normal implement cultivation in the inter-row may have possibilities.

A difficulty which immediately suggests itself is the fact that the soil must not be disturbed once the spray has been applied to the surface. In many areas cultivation to loosen up the soil is essential. However it may be that cultivation could be immediately followed by a pre-emergence spraying particularly in the case of the last working before the cane is out of hand. Other normal operations such as filling in the drill or removing part of the soil cover will undoubtedly affect the general use of these sprays. Fertilizing and benzene hexachloride application may present additional difficulties.

Experiments to date have not been successful in obtaining pre-emergence control on heavy soils which crack on drying out. As previously mentioned weeds and grasses will germinate and grow from these cracks, the sides of which have not been reached by the spray. It is also necessary to remember that 2-4D will not inhibit the germination of nut grass under normal farm conditions. In stony areas, large pieces of stone will protect the soil and weeds will subsequently grow from underneath. The same is also true of odd pieces of trash and other rubbish.

Advantages.

Notwithstanding the difficulties mentioned above there is no gainsaying the fact that there is undoubtedly a place in farm management for a weed control method that will give from two to three months' control in many cases with a single spraying. Its use immediately after planting or grubbing in ratoon crops has definite possibilities. Furthermore it would appear to have distinct value for rainy season control of weeds and grasses when, because of wet conditions the usual mechanical methods are impossible. On soils such as red volcanic loams, where inter-row cultivation serves no purpose other than to destroy weeds, it seems not unlikely that one, or possibly two, sprayings will be all the treatment necessary from planting or ratooning until the cane is out of hand.

Recommendations.

At this stage some diffidence is felt insofar as the making of actual recommendations is concerned. It must be emphasised that the work done to date has been of a purely experimental and exploratory nature. However it should be realised that the Bureau can conduct only a limited number of these trials and moreover weed control requirements vary, not only from district to district, but also from farm to farm Therefore it is felt that in view of the excellent results that have been obtained in many cases, growers may wish to try out pre-emergence spraying, possibly in a small way at the beginning, ultimately adapting the method to suit their own particular requirements. It might also be mentioned that a further series of trials is being set down this year, the results of which will be published from time to time in this Bulletin. A particular feature of these experiments is the combination of essential cultivation requirements and spray applications. Consequently, rather than attempt definite recommendations at the moment it is felt that the information outlined by the following points will provide a more useful working basis for those growers who wish to give pre-emergence spraying a trial on their own particular properties.

Points to Remember in Pre-emergence Spraying.

1. A suitable rate of application is 4 lb. of 2-4D per acre.

2. This should be dissolved in 50 to 60 gallons of water when used in a knapsack spray. With a power spray approximately half this quantity is convenient.

3. The soil should be completely clean from weeds and grasses at the time of spraying.

4. Very lumpy or stony soils prevent complete coverage of the soil being obtained.

5. Cracking on heavy soil prevents effective pre-emergence control.

6. Light sandy soils and soils which require little cultivation are particularly suitable for the use of pre-emergence sprays.

7. A suitable time to spray is immediately after planting or grubbing.

8. The soil should be left undisturbed after spraying. Footmarks made during the spraying do not reduce the effectiveness.

9. 2-4D does not give a pre-emergence control of nut grass.

10. Preliminary experiments indicate that it may prevent to a certain extent the germination of guinea grass. The results are promising but not yet conclusive.

11. Under suitable conditions two or three months' freedom from weeds may be expected from one or two sprayings.

12. In the trials so far completed no ill effects on cane have been observed.

CONTACT SPRAYS.

In addition to the pre-emergence work a considerable amount of investigation was carried out with contact sprays. These sprays consisted of weed killing chemicals which, unlike the pre-emergence spray, are applied directly to the growing weeds and grasses. Several different

types were used. The sprays first tried contained either diesel or tar oil as a base together with sodium pentachlorphenate. To this was added a quantity of 2-4D which in addition to its own contact weed killing power also provided a pre-emergence effect.

The results obtained so far have not been greatly successful. Although these sprays will kill weeds and grasses if used in sufficient quantity there are two factors to be considered. Firstly the cane will also be killed or severely damaged by such heavy concentrations and secondly the cost of materials per acre is in most cases uneconomic. However the present indications are that an economic application of the diesel oil based spray can be made without injuring the cane *provided* the weeds and grass seedlings are sprayed when very young.

Since diesel oil is not soluble in water it is necessary that it should be emulsified before it can be put to practical use. Although this can be done by the addition of an emulsifying agent it unfortunately adds materially to the cost which is, of course, undesirable. A spray which seems to be showing more promise than either the diesel or tar oil is one in which creosote is used as a base. Sodium pentachlorphenate and 2-4D are also added. Here again good results can be obtained without very much risk to the cane if the spray is used in the early stages of weed and grass growth. However, further information regarding the most efficient and economical rates of application has yet to be obtained and trials to this end are being laid down.

If a successful contact spray can be found which will not injure cane and which is not too costly to use, it will be extremely valuable when used in conjunction with the pre-emergence spray. The ideal combination would be to use a 2-4D pre-emergence spray just after planting or ratooning. Immediately this loses its effectiveness and weeds and grasses begin to appear, a contact spray also containing 2-4D would then be applied for the purpose of destroying the emerging seedlings and providing further pre-emergence control.

LEGUME INOCULUM TO BE FREE.

In the past it has been customary to charge a nominal fee of 1/- to cover packing and postage on each consignment of legume inoculum sent to cane farmers.

However, we are now pleased to announce that in future all cane farmers will be supplied with cultures free of charge.

Farmers are again reminded of the advantages of legume inoculation and are invited to make full use of this valuable service. When ordering cultures the type of legume, quantity of seed and date of planting should be given, and to avoid delay this information should be forwarded to the Director at least a fortnight before the proposed date of planting.

D.R.L.S.

A Power Spray for Applying Chemical Weedicides.

By H. G. KNUST.

DURING 1949 successful large-scale field experiments with chemical weedicides were conducted on the Bundaberg Sugar Experiment Station and for the purpose of these trials a power spray for the application of weedicides was employed.

Since so much interest has been shown in this aspect of weed control it is felt that a description of the equipment and details regarding its operation would be of interest to canegrowers seriously contemplating the use of chemical weedicides for pre-emergence weed control.

FIG. 3.—Power spray with booms in position for spraying.

The boom spray used (Figures 3 and 4) was made by a Brisbane firm to Bureau specifications and consists of a container of 60 gallons capacity set on a light angle iron platform bolted to the final drive housing and drawbar of a Farmall model A.V. tractor. At the rear of the platform a standard, 3 feet long, is welded and braced. This has holes drilled in it at 4-inch centres to coincide with holes in the semi-circular boom frame (Figure 5). The whole boom section may be adjusted to any desired height for delivery of the weedicide, by loosening the two wing-nuts in the control part of the frame work; chains attached to the top of the standard extend to within 3 ft. 8 in. of the end of each boom for the purpose of stabilizing the booms. The base of the boom frame—which is 1½-inch angle iron 4 feet 6 inches in

length—is drilled to take ½-inch galvanised water piping elbows, into which the booms are screwed. Each spray boom consists of a 12 feet 3 inch length of ½-inch galvanised water piping and into these lengths are welded couplings capable of taking ¼-inch droppers 12 inches long, to which the nozzles are screwed. Each spray boom carries six droppers; the first dropper is fixed 11 inches from the inner end of the boom and the remainder alternately at intervals of 2 feet and 2 feet 6 inches.

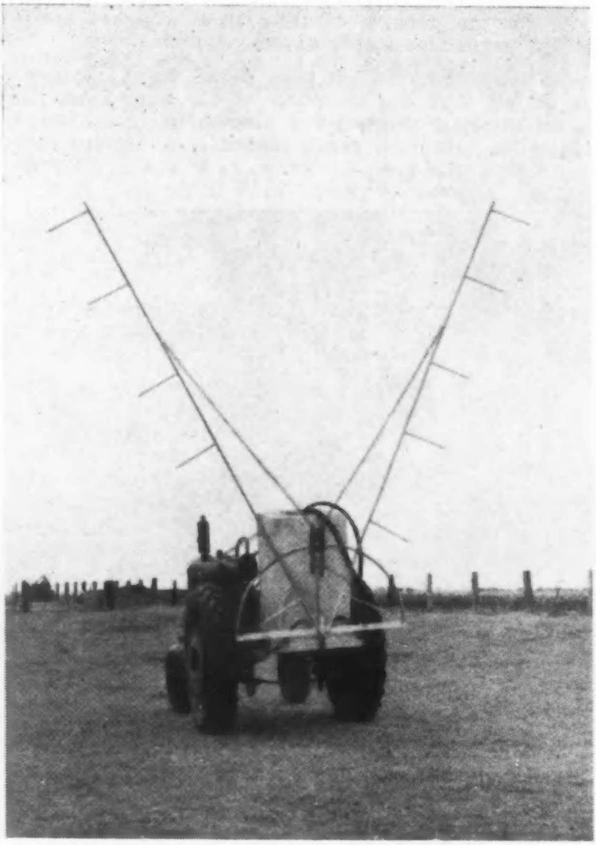

FIG. 4.—Power spray with booms raised for transportation.

The nozzles used are the "Greenhouse" type of about 1/16 inch bore. Shackles are welded to the spray boom and are clamped around the semi-circular section of the frame work for the purpose of holding the boom in position when raised for transportation, or when in the horizontal position for spraying.

The pump is a 1-inch geared type having a 1½-inch reinforced hose fitted to the suction end and a two-way valve fitted at the discharge end. This is connected to a 1-inch hose for discharging surplus liquid

back into the tank and to two ½-inch hoses which connect with the boom spray lines. The intake end of the suction hose is fitted with a fine mesh screen—about 90 mesh—which excludes extraneous matter when pumping from horse troughs, creeks, &c., to fill the supply tank. The pump is driven with an "A" section V belt from a 9-inch pulley fitted to the tractor power take off.

For pre-emergence control of weeds in plant cane the drills were shaped with a cotton king immediately after the cane was planted and the tractor was driven empty in the row interspaces in which it was intended to travel when applying the weedicides. By adopting this practice uniform tractor speeds were maintained when applying the weedicides and the tractor driver had little difficulty in holding the tractor on interspace crowns. No doubt this procedure could be dispensed with after a little practice.

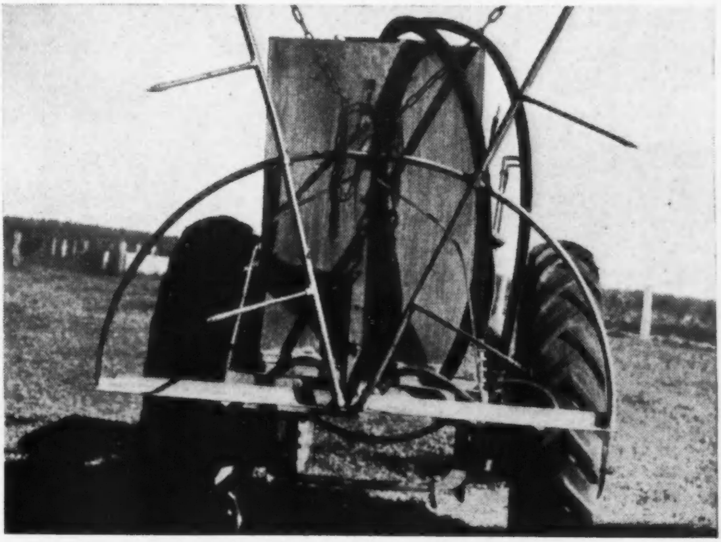

Fig. 5.—Showing attachment of semi-circular boom frame.

For pre-emergence control of weeds in ratoons no shaping of drills was necessary but after the initial ratoon cultivation, the row interspace in which it was intended to travel to apply the weedicide was compacted as in the case of plant fields.

The most satisfactory tractor speed was found to be about 2.1 miles per hour with the tractor in low gear. At this speed it was possible while using the small nozzles to apply 21 gallons of liquid per acre and cover about 6 acres per hour.

This type of boom spray has much to commend it for spray work in cane fields, because it has few moving parts, can be easily attached to and removed from the tractor, and the spray nozzles can be simply adjusted to deliver the weedicide in any horizontal direction.

Care should be taken to screen thoroughly the liquid and/or material used and it is recommended that double screening of liquid should be practised when filling the container from horse troughs or creeks.

A Useful Machine for Spraying Potatoes.*

W. G. STEELE, Senior Adviser in Agriculture.

WITH the advent of DDT and its successful use in controlling potato tuber moth in the field, potato growers have become interested in the practical application of DDT sprays to potato crops. A primary need was a cheaply constructed spraying machine of horse-drawn type to supplement the manually operated knapsack spray pump commonly used for such purpose.

An outline of the type of machine required was given to a local machinery manufacturer at Boonah and, after some experimenting, a machine of simple construction was produced. This was reasonably priced and gave a satisfactory performance. Spraying four rows at a

FIG. 6.—View of potato spraying machine ready for operation.

time, a maximum rate of 50 gallons per acre can be applied to give a good cover to the plants. The machine can also be used to spray other crops, such as pumpkins and lucerne.

The machine (Figs. 6 and 7), which is drawn by a single horse, consists of a 44-gallon drum fitted to a frame mounted on two wheels each 27 inches in diameter. From the rear of the drum a $\frac{3}{4}$-inch galvanised iron pipe leads to a brass rotary pump which forces the spraying liquid through to a spray boom fitted with cyclone type nozzles. A shut-off tap is fitted in the line before entering the pump and a gauze strainer is also included. By connecting the pump and boom by means of a length of rubber hosing, allowance is made for the boom to be raised or lowered on the supporting standards to suit any height of crop.

* Reprinted from the "Queensland Agricultural Journal," Feb., 1950.

The pump is rotated by means of a gear wheel, fitted to one of the land wheels, which drives a smaller cog on a counter shaft. From this shaft the drive is taken by means of a rubber V belt and pulleys on to the pump shaft. At ordinary cultivating speed the pump is estimated to make 300 to 350 r.p.m. This gives a fine mist which covers the plants well. Three spray nozzles, spaced 8 inches apart, are fitted above each row; these may be screwed out if desired and replaced by small bolts so that one or two nozzles only are operating per row. This permits a

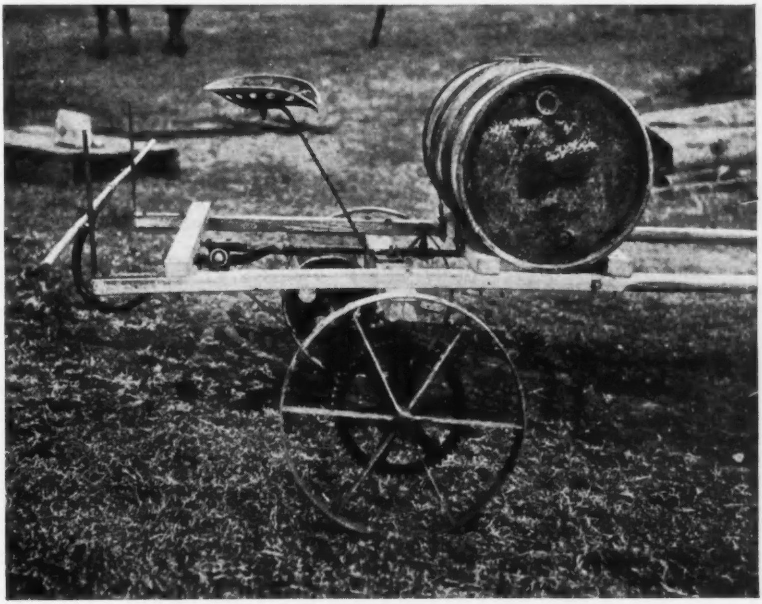

FIG. 7.—Close view of pumping mechanism.

saving of material if small plants are being sprayed. The span of the land wheels can be altered so as to allow for row widths of 27 to 33 inches.

Up to the present about 10 of these machines have been placed on farms throughout the Fassifern, Charlwood and Aratula areas, and more have been ordered. In some localities growers have purchased a machine on a group basis so that several farms are served by the one machine.

ERRATA.

Attention is called to three typographical errors which occurred in the article entitled "Soils and Plant Nutrition," published in the January, 1950, issue of the Quarterly Bulletin.

1. On page 95, in the second line of the last paragraph the word "presence" should be substituted for "absence."

2. On page 101, in the first line of the last paragraph the word "Loam" should be deleted.

3. On page 102, in the sixth line of the second last paragraph the word "humus" should be substituted for "lumps."

Testing Sugar Cane Varieties for Resistance to Disease.

By C. G. HUGHES.

Introduction.

It is common knowledge that Queensland cane fields provide or have provided a refuge for a greater collection of diseases than any other single sugar-producing country. Besides most of the important diseases of other countries we have at least two, viz., dwarf and the recently recognised ratoon stunting in Q.28, which have not been recorded elsewhere. Faced with this solid opposition to a thrifty growth and development sugar cane would be a very chancy crop to grow but for the important fact that different varieties of sugar cane vary in degree of resistance to various diseases. This is known by practically every farmer, although its significance is not always fully appreciated. Thus varietal difference is a potent weapon for the fight against disease, and the use of resistant varieties or those of lesser susceptibility is the chief method of preventing damage and loss by specific diseases.

These resistant varieties may be obtained either—

(i.) by importation from other countries, or

(ii.) from our own cane-breeding activities.

Queensland, in common with the other progressive sugar-producing countries, uses both sources. Importations are made regularly every year and in order to prevent the introduction of insects or diseases from other countries the canes have to spend one year in an insect-proof quarantine house at Brisbane before they are released for propagation at the Sugar Experiment Stations. As an example of the scale of these importations, the quarantine house at the moment is growing fifteen varieties, including canes from India, Argentina, Formosa, Java, United States of America and New South Wales. Mention of these sources of supply calls to mind the Co. canes such as Co. 290, which came from India, P.O.J.2878 and other P.O.J.'s. from Java, and C.P.29/116 from the United States, all of which have proved so valuable to us at one time or another.

Queensland cane-breeding activities compare favourably in scope with the overseas work and many thousands of new seedlings are planted out each year for selection and testing. Only a few of these survive the long and testing road to commercial propagation for there are many disappointments for the plant breeder between the planting of the original seedlings and the appearance of a new variety on the approved lists. However, these few survivors are important canes, e.g., Q.50, Trojan, Pindar, Q.28, Q.44, Q.47 and Q.49, and locally bred seedlings will continue to figure prominently in the production statistics.

Whichever method of obtaining new varieties is adopted, the resistant varieties still have to be separated from the susceptible in the varied assortment from each group. This sorting or testing for disease resistance may cause the discard of a very high proportion of the new canes many of which might be desirable from all other points of view. Of course as districts become free from disease the number of varieties available to that particular district increases because susceptible varieties

may then be grown there. A disease may not be causing significant losses in an area but its mere presence is sufficient to prevent the introduction of promising new but susceptible canes, which might increase the yielding capacity of the district.

Fig. 8.—Map showing the important diseases in the ten sugar cane quarantine districts.

Before discussing the methods employed by the pathologists of the Bureau of Sugar Experiment Stations to determine resistance or otherwise to disease it would be desirable to consider the diseases against which precautions have to be taken.

Cane Diseases in Queensland.

In the past it was possible to divide the diseases occurring in Queensland into two fairly distinct groups:—

(i.) The "major" diseases causing gross damage and loss of tonnage and

(ii.) the "minor" diseases, which were generally considered unimportant.

However, the constantly changing varietal scene, the eradication of old diseases and the sudden appearance of new ones, shift the emphasis from disease to disease as time goes on and a classification made even a few years ago is now out of date. For instance, it is not so long ago since gumming was very definitely a "major" disease in Queensland causing losses in field and mill, and Fiji disease was causing whole fields to be a total loss; by contrast gumming is now present in one mill area only and even there it appears to be on the verge of extinction, whilst Fiji disease has been eradicated from the Maryborough area where it was worst, and is being brought under control elsewhere. Another example of changing status is given by the disease known as red rot, which although usually called a "minor" disease a decade or more ago has led to the discard of Co.290 in South Queensland and has caused serious losses on individual farms in some of the new varieties in the central districts. It is advisable to regard *all* diseases as actually or potentially important.

An endeavour is made in the accompanying map of the State to show the diseases which are important because of their actual occurrence or the threat they represent to the current popular varieties, in relation to the different cane growing regions. The ten quarantine areas as defined by the Sugar Experiment Stations Acts serve to delineate the regions and since they were instituted primarily to prevent the free movement of cane from one sugar growing district to another as a measure of disease control, they define fairly accurately the extent of the various important diseases. It is noted that Fiji disease is confined to South Queensland, whilst leaf scald occurs in commercial crops only in the north, chlorotic streak is found in the north and the south and downy mildew is also a threat to both northern and southern crops. Pineapple disease is most serious on the Burdekin and ratoon stunting at Mackay. Resistance trials are run against these diseases, and mosaic as well, so that the reaction of every new cane is known before it reaches commercial plantings.

General Principles of Resistance Trials.

Each disease must be considered separately in planning resistance trials. It is impracticable to test the reaction of a variety to more than one disease at once, firstly, because diseases usually require different conditions to reach their full expression and, secondly, the damage to canes, sticks or stools by one disease may mask the symptoms of the other. Furthermore the presence of one disease may alter a variety's degree of susceptibility to another disease. There is therefore only one disease in each trial.

The general aim of a trial is to produce conditions suitable for the expression of the disease in a comparatively small area and in a limited time, generally one year, and with complete safety as regards the nearest

commercial crops. The element of chance in infection must be reduced as far as possible. This can be done by inocculating the disease into the setts or leaves or by providing sufficient points of infection in the trial to be certain that every variety is exposed equally to the disease.

Since even heavily diseased fields show an unevenness of infection it is necessary, except where artificial inoculation is reliable, to plant, say, three plots of each variety. Any differences in infection in different parts of the trial area are then smoothed out and a more reliable figure can be arrived at than would be obtained from a single plot.

The interpretation of the figures obtained from a disease resistance trial depend to a large extent on the care exercised in choosing the standard canes; against which the reactions of the new canes are tested. The standards selected usually show a range of resistance from very susceptible to very resistant and their field reaction to the disease has to be well known and thoroughly understood. The standards used vary, of course, from disease to disease and owing to the comparative rarity of major outbreaks in commercial crops, the numbers of standard canes available for inclusion in the trial does not alter materially from year to year. In the future as the disease position as a whole improves there will scarcely be any addition made to the list of standards.

Location of the Trials.

At the present time disease resistance trials are located in various centres from near Cairns, North Queensland, to Eagleby, south of Brisbane. With most diseases isolation from cane farms is essential, yet each trial must be on a farm where it can receive regular attention and can be inspected periodically by Bureau officers. In addition, when a disease approaches extinction in a district the resistance trial for that disease must be moved right out of the district, for even a remote chance of infection in a clean area cannot be tolerated. In any one year there are six or more trials in operation with a total of more than fifty varieties under test. This testing of all new canes coming forward is an important part of disease control and although unpublicised and generally not realised by the farmer, has far-reaching effects on the health of his crops and the varieties he is able to grow.

In subsequent issues of the Cane Growers' Quarterly Bulletin it is proposed to deal in detail with the trials against individual diseases and to include lists of the reactions of commercial canes.

Benzene Hexachloride Distributors.*

By G. WILSON.

Introduction.

THE application of benzene hexachloride (B.H.C.) for the control of the larvae of the greyback beetle, *Dermolepida albohirtum* Waterh., in North Queensland, has proved so successful that the area treated has increased rapidly since its inception as field practice in 1947. In that year 2,900 acres were treated, in 1948 7,000 acres, and in 1949 the area is expected to exceed 20,000 acres. In some mill areas machines owned by Cane Pest and Disease Control Boards are hired out to cane growers for applying the insecticide. In others the growers depend on their ingenuity in adapting existing fertilizer distributors or on one or other of the machines specially designed for the purpose. The capacity of existing machines is taxed to the utmost and these notes may assist the cane grower to select and adapt a distributor for his individual use. The method of application should be selected to effect a minimum of alteration or addition to the normal routine of cultivation and the machine should be available at the optimum time for the application.

Time of Application.

The drills of young plant cane are generally kept open as long as possible to allow the cane to stool and to reserve the soil for weed control purposes when the cane becomes too high for implements that straddle the row. During this period the soil is intermittently removed from the drill by means of the cotton king, spinning chipper or cane cleaner. B.H.C. should not be applied during this early stage because some or all of it may be removed from the drill with the soil. When the cane is too tall for straddling implements weed control has to be effected by implements that move soil into the drill. The B.H.C. should be applied immediately before the drill is filled in so that it is mixed with the soil in the drill to a depth of a few inches by the time cultivation ultimately ceases for that crop. If the spring season is very dry the drill may be filled in with soil prematurely, conservation of the soil moisture being then the most important consideration. The B.H.C. should not be applied at this stage if it is considered likely that the soil will be removed after rain falls. Under these conditions it is desirable, if weather permits, to apply the B.H.C. after reopening the drills, but before the cane is too large. Alternatively, it may be buried in the furrow. For the treatment of ratoons B.H.C. should be applied three to five inches below the surface of the soil and as close as possible to each side of the stool. This should be timed so that subsequent cultivation or fertilization will not break up and scatter the band.

Characteristics of Suitable Machines.

Distributors which are suitable for use with B.H.C. may be divided into two general groups—independent and attached—depending on whether the unit is self-contained on a carriage or whether it is mounted on a tractor or other implement. Those in the latter group may have independent drives or they may be driven by the tractor or supporting implement. The width of the band of B.H.C. deposited and its position

* Paper presented at the Cairns Conference Q.S.S.C.T., April, 1950.

in relation to the row of cane vary considerably, and although in most machines the flow of dust may be controlled at the point of delivery, these features are of particular importance in selecting a distributor.

Mechanical differences in the feeding arrangements and regulating devices distinguish the machines of the various manufacturers, but they are of secondary importance when a selection is being made. There are two basic types of feeding arrangement—rotating and vibrating. The former group make use of devices such as a star feeder, butterfly, peg, worm, or grooved shaft. The control of the rate of delivery is achieved, in general, by means of a variable aperture, a variable gear ratio, or a combination of the two.

Independent Machines.

Independent carts of the two-wheeled type such as the Mourilyan machine, local modifications thereof and the Sunshine drill are greatly improved if fitted with a long axle so that the wheel track may be extended at will up to about seven feet. This enables the carts to be used in young plant cane in which the interspaces are steeply hilled or in ratoons where the soil has been cut away from the rows of cane. The need for a wide wheel track is accentuated on loose, sandy or friable soils and on hilly fields. The wide-tracked wheels travel in the depression of the drill on either side of the one being treated, but not close enough to the cane to cause damage. This compels the cart to travel in alignment with the drill and prevents the "crabbing" that inevitably follows any attempt to draw the cart along the mounds in the interspaces. In the machines employed by the Mulgrave Pest Board the wheels may be adjusted without difficulty to any desired width between 4 and 7 feet. For drills 4 feet 6 inches apart a track of 6 feet 10 inches has been found convenient. Furthermore, the diameter of the axle on the Mulgrave machine has been increased from the usual 1½ inches to 1¾ inches since the original axle bends slightly at full extension. In the Sunshine plantation drill and similar machines standard sprocket parts limit the diameter of the axle to 1½ inches. If the standard cast iron axle hangers on such machines crack under the strain of the extended axle they should be replaced with hangers fabricated from steel.

Independent machines may be either horse- or tractor-drawn. If the distributor is tractor-drawn, it is usually essential to have a second man in attendance to see that the flow of B.H.C. is maintained. As ample power is available it is often possible to attach other implements, such as a cotton king, in train to avoid unnecessary operation of the tractor. If horses are used the driver can attend to the contents of the hopper and he is usually seated on top of the cart. It is possible to cover 7 to 9 acres per day with horse-drawn machines, while with those drawn by wheel tractors operating in third gear, 13 acres may be treated. Some operators claim to have treated 2 acres per hour in this way.

Attached Machines.

The attachment of the distributor on a tractor or implement may overcome the difficulty of alignment and should effect economy of operation by making the application of B.H.C. concurrent with some routine cultivation. This is becoming more important with the increase within recent years in the number of cane growers who have dispensed with their horses.

If the feed drive of an attached distributor is taken from the tractor or implement the gearing requires consideration so that the speed of rotation of the feeding device will maintain the same relation to ground speed as that in the original design or, if it is altered, it must then be more suitable to the rate of application of B.H.C. The greatest source of error so far encountered in practice lies in the use of drive speeds which are too high. This makes it necessary to reduce the opening in the feed aperture so much that obstruction takes place easily. Sluggishness in the movement of the B.H.C. dust enables it to bridge a small opening, especially in humid weather. With a larger opening there is little tendency for bridging to occur. Three factors interact to control the rate of flow, namely—the rate of drive, the size of the aperture, and the dimensions of the feeding parts. Attention to the correlation of these factors is usually required in adapting a distributor designed for some other purpose.

Attached distributors include star feed fertilizer distributors intended for attachment to grubbers; similar types of distributor taken off wheeled carts; the Pezzutti and Camuglia distributors; and pairs of single acting units such as the Don or Hodge conical hoppers usually found on cane planters.

Width and Placement of the Band.—In the design of distributors for B.H.C. careful attention has to be given to the method of delivery so that the material is correctly placed. There are three main sets of conditions to be considered—in plant cane it has to be placed in open drills; in cut-away ratoons it must be placed in two separate furrows; and in plant cane where the drills have been closed or in ratoons that have not been cut away it must be placed in level soil.

Its application is most easily carried out in plant cane with deep wide drills and many types of distributor are satisfactory under these conditions. In shallow soils the drills are often narrow and the interspaces flat in contour. Care must then be taken to ensure that the B.H.C. is distributed in a band narrow enough to fall within the drill. It is desirable to spread the B.H.C. from the sides of the drill towards the centre of the stool, and this is more easily done if the surface soil is friable. If the surface soil has been compacted by rain there is a tendency for the material to remain in a narrow band and the following cultivation merely turns the soil from the interspace on top of it. Some surface cultivation should therefore precede the application if the surface soil has been compacted.

The application of B.H.C. to cut-away ratoons is similar to the operation in plant cane, although there are several methods of adapting machines so that the spacing of the bands suits the furrows. In the third case the B.H.C. should be buried, and this may be accomplished by cultivation after a surface application. However, the scarifier or grubber tynes may simply disperse the material laterally in the soil pushed on to the stools, instead of burying it to the required depth. The delivery may be made through tubes attached to tynes, but this arrangement is not popular as the ends of the tubes are concealed and it is impossible to observe a break in the flow of the B.H.C.

Individual Machines.

It is proposed to discuss only the general principles involved in particular machines rather than to describe them in detail. The construction of the important parts will be considered especially in regard to modifications necessary to improve the operation of the distributor.

The Mourilyan Machine (Fig. 9 and 10).—This is a two-wheeled cart in which the axle passes through the hopper. The axle carries two groups of radial pegs of steel ½ inch in diameter and 1¼ inch in length. The pegs are placed 1 inch apart along the axle, and each passes over an elongated slot in the base of the hopper. By arranging the pegs in a staggered fashion round the axle it is possible to provide a continuous flow from the hopper. The rate of flow to the two chutes is controlled by a plate by means of which the sizes of the openings may be altered

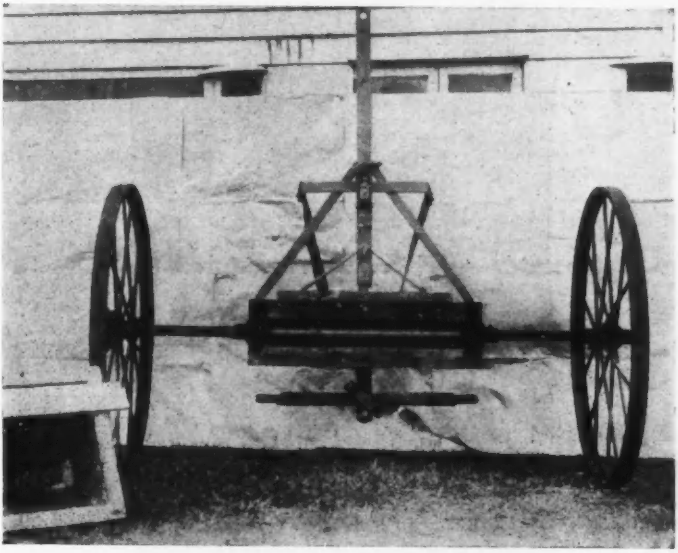

FIG. 9.—Illustrating the modified Mourilyan distributor with the hopper removed.

as required. Originally the machine was adjusted to give a total spread of 34 inches but this was too wide, and it has now been modified to give a spread of 22 inches. This was done by closing all holes except the innermost 5 of each group and by inserting a metal slide in each chute. In addition the control plate has been transferred from the rear to the front of the hopper, and it has been altered so that the holes may be completely covered for turning and travelling. Care has to be taken to loosen material that may be packed by the rotating pegs when the holes are closed. A draw bar permits the attachment of scratchers on either side of the drill and these are wide enough to distribute the two bands of B.H.C. into the centre of the drill, when plant cane is being treated.

The Camuglia Distributor.—The fertilizer distributor described by Camuglia (2) as a tractor attachment has been used successfully, and without modification, as a horse-drawn cart on two wheels, to distribute B.H.C. dust at rates of 50 and 100 lb. per acre. The wheel ratchet clutch was used at the end for turning. It is considered that the adjustment of the slides could be improved by fitting a threaded stud rather than a series of peg holes to regulate their position. This cart has tynes attached to the down pipes. They are 21 inches apart and may be used for burying the B.H.C. when treating ratoons.

FIG. 10.—A view of a Mourilyan spreader working in a field of ratoons behind a cotton king.

A Babinda Distributor.—A wheeled fertilizer distributor similar to a lime spreader has been contructed in the Babinda area. It delivers the fertilizer or B.H.C. dust through two circular apertures by means of rotating flat paddles about 3 inches long, fixed to the main axle, which passes directly through the hopper. Additional paddles along the shaft assist in breaking up lumpy fertilizer. With the existing design the minimum rate of application possible was 90 lb. per acre.

The Sunshine Plantation Drill.—This distributor comprises a two-wheeled cart carrying a hopper fitted with two outlets. (See Fig. 11.) The feeding arrangement for each outlet consists of a rotating vertical spindle carrying at its upper end a horizontal star. The spindles are driven by means of a chain drive and bevel gears from the axle of the

cart. The alternate passage of a point and an indentation of the star past the outlet permits B.H.C. to fall into a chamber below. From here, it passes through a variable aperture to the delivery chutes in tynes which make the necessary furrow. This machine maintains a uniform rate of flow through a wide range of speeds, but the interior

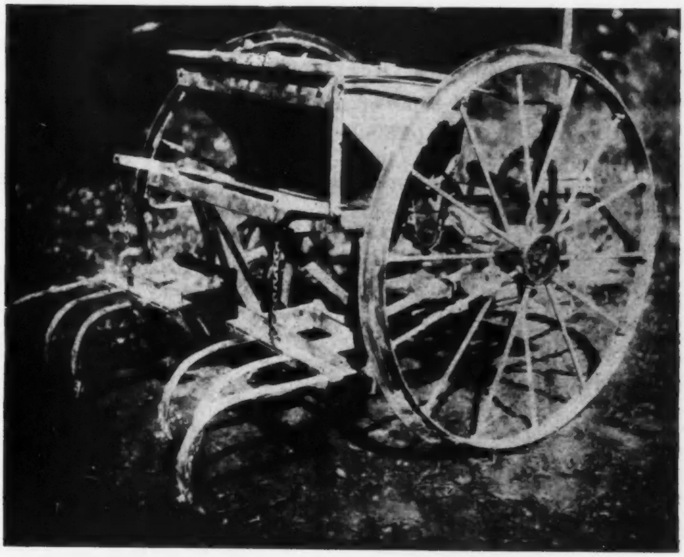

FIG. 11.—A view of the Sunshine Plantation Drill with scarifier attachments.

must be absolutely clean and dry. The agitator is of little importance and might well be removed since its action is not sufficient to ensure constant flow. For use in the open drill in plant cane the tynes or disc openers should be removed. The pliable rubber tubes fitted to the machine are too flexible and are too easily bent by the cane stalks. Instead each chute should be fitted with a piece of 2 in. radiator hose 18 in. long. This may be supplemented in windy weather with a piece of hessian, reaching almost to the ground, and tied round the bottom of the tube with an opening facing forward. Thus in the case of a rise in the soil there is no possibility of B.H.C. falling on to the hessian and being carried along. The down pipes of these distributors are 20 in. apart and the two bands of B.H.C. are within the span of most scratching implements. These spread the B.H.C. and may be attached to the cart, or used later on a cotton king or other implement. An extension welded across the rear of the angle iron chassis may be used to carry scratchers or scarifier tynes. These may be coupled with the clutch handle of the distributor so that they are lifted when the feed drive is shut off for turning.

Three inter-changeable stars are available for this machine. The largest of these (D.838) is the one most commonly used for fertilizer and it is quite suitable for applications of 80 lb. or more per acre of B.H.C. dust. The intermediate star (D.1), or the smaller type (D.2), may also be used, and thus a wide range of movement of the regulating slide may be obtained for lower rates of application. In all machines employing the star feed a cover plate is fitted over portion of the star. This prevents unmeasured dust from falling down the chute, thus rendering the rate of delivery irregular. The plate is sometimes removed to increase the rate of application of fertilizer, but its presence is essential for accurate work with B.H.C.

The feeds from two sides of a Sunshine Drill are almost always unequal, though there is no apparent fault in the machine. The discrepancy may be corrected quite easily in the following way. The two deliveries are calibrated and the side delivering the faster flow is adjusted until it gives half the required rate. This is done by removing a portion of the rear regulating slide containing the aperture at a point between the base plate and the pivot of the control handle. The two pieces are then rejoined by bolting a strap of the same width across the cut. Holes are drilled on either side of the cut and at a corresponding spacing on the strap. One of the holes in the strap is extended into a slot so that the distance between the two pieces may be varied. In this way one feed aperture can be enlarged independently and the flow may be increased to any desired rate.

The "Sunfurrow" Drill.—A subsidiary unit to the Sunshine plantation drill is the small Sunfurrow drill, drawn by a single horse. This machine is fitted with a recurved blade under the hopper so that a furrow may be opened on one side of a drill. By means of a star feeder and chute the Sunfurrow drill delivers to this furrow. Although slow in action, this implement has the advantage that it can be used in high cane, on very hilly country, or wherever manoeuvreability is essential. For open drill work, the blade may be removed or the front wheel lowered to raise the blade out of the soil. This should be done as the blade tends to bear the weight of the machine and this causes the driving wheel to slip. The alteration of the blade to a pointed share would be a distinct advantage. Provided the soil is well cultivated to reduce wheel slip, the blade could be used to bury the insecticide. In young plant cane the Sunfurrow drill should be driven with the chain next the cane row. If driven in a deep drill with the chain next the hilled up interspace the chain may pick up soil and tighten, thereby causing the slip.

The control of this machine is not as fine as that of the Sunshine plantation drill, the regulating slide being fixed by a split pin in one of a series of holes. The difference in flow from one position to the next is often too great for work with B.H.C., but finer control may be obtained by using a smaller star or by various improvisations. On older models of this machine the shape of the feed aperture is that of a quadrant of an ellipse, but on recent models the aperture is in the form of a large parallelogram. Care and patience are needed in the regulation of the rates of flow in these machines.

Several other manufacturers produce distributors using the star feed, but without a variable feed aperture. The regulation in these models is achieved by means of interchangeable stars and gears. The rates of feed available do not always coincide with those required for distributing B.H.C. and some modification is generally necessary. One practice is to purchase several stars and reduce the length and thickness of the points until by trial and error the desired rate is obtained. One such adjustment was made by a grower who transferred the hopper of an old Massey-Harris cart to the chassis of a spring tooth cultivator, using the Massey-Harris wheels so that the speed ratio remained unaltered. An easier method is to cut a false base plate with a hole in the centre to fit over the star spindle and then by trial and error cut a feed aperture of smaller size to give the desired rate. This has a disadvantage in that it cannot be altered slightly at will to suit the condition of the dust.

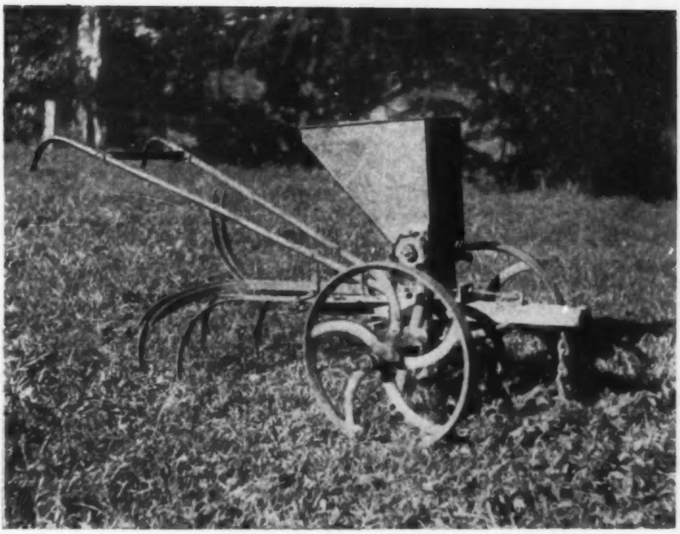

FIG. 12.—The Lizzio distributor.

The Lizzio Distributor.—The Lizzio distributor, shown in Fig. 12, has been widely used in treating plant cane. It consists of a light steel hopper mounted on the front of a wheeled scratcher. A shaft in the bottom of the hopper carries two blades above the feed apertures which are 7 in. apart. The shaft is driven from a wheel of the scratcher by means of a sprocket and chain drive. By varying the sizes of the apertures the rate of application of the material may be controlled. The two feed apertures are too close together to straddle ratoon stools; the low elevation of the machine and the position of the land wheel drive make it impracticable to spread the delivery tubes to sufficient width for this purpose. The writer has not met any grower who has overcome these difficulties in practice, but suggestions from various sources include the following:—The wheels may be extended outwards

along the existing axles and the drive may then be transmitted from the land wheel to the primary sprocket. A piece of pipe is fitted over the axle between the wheel and sprocket. The pipe has two projections at one end which fit into slots in the sprocket, and a recess at the outer end which fits on a driving pin studded into the land wheel. Incidentally, two studs should be provided on the land wheel since one may shear off. The alignment of the hopper may be altered so that the driving chain will slope backwards and not interfere with the outward spread of the feed tubes. The distance between the feed apertures might well be increased to reduce the slope on the down pipes since even for plant cane such a narrow delivery is not necessary.

The chief advantage of this machine is its manoeuvrability and good alignment. This enables the wheels which are approximately 2 ft. apart to ride in the depression of the drill. In its standard form with a regulating slide aperture $1\frac{1}{4}$ in. long and $\frac{5}{8}$ in. wide it delivers up to 110 lb. of B.H.C. dust per acre. By increasing the width of the feed aperture to 1 in. a much higher rate is possible, but the paddles create packing around the feed aperture, thus reducing the flow. Furthermore, the widening of the aperture causes loss of control at lower rates. One proposal to overcome this is to make a long slot tapering from $1\frac{1}{4}$ in. at the rear to $\frac{1}{2}$ in. or less at the front. The regulation would be improved by the provision of a threaded stud to contact the edge of the slide, so that its position for any rate of application could be adjusted by counting the threads. The packing in the bottom of the hopper could probably be reduced by extending the paddles across the hopper to churn up the dust. A rather similar type of machine uses a paddle consisting of a hollow square about 3 in. wide and $1\frac{1}{2}$ in. deep. This extends well across the feed aperture and probably effects considerable agitation. A vibrator was fitted to a Lizzio distributor and an improved flow resulted.

The Lizzio machine is provided with a clutch and an additional slide below the hopper which closes the apertures for travelling. These are operated simultaneously by a hand lever from the driving position. The B.H.C. is distributed and covered by means of the tynes of the scratcher. A device which greatly improves the covering consists of a 10 in. strip of $1\frac{1}{2}$ in. spring steel clamped to each outside tyne at the soil level. The strip extends forwards and outwards at an angle of about 45 degrees and scrapes soil from the interspace on to the band of B.H.C. The device is used with the longest tyne on the outside so that it operates after the shorter tynes have scattered the insecticide.

The Vibrator and "Suntapper" Distributors.—The Vibrator and Suntapper distributors are vibration fed machines well known to cane growers. They have been successfully used to apply B.H.C., but it is well known that the material is vibrated from the front to the rear of the hopper and a much greater rate of delivery takes place when working uphill than when travelling down. Some farmers regulate the delivery for fertilizer by setting the machine to the required rate for downhill travel and reducing the flow for uphill operation by taking some pressure off the tapper. On undulating hillsides a skilful operator may accomplish this by keeping a hand on the release wire instead of shifting the set lever. Such methods are, however, not sufficiently accurate for the application of B.H.C. Besides, if the soil is very loose, wheel slip will almost certainly occur and these types should

therefore be restricted to fairly firm soils on level fields. Under such conditions the writer has applied 50 lb. of B.H.C. per acre to ratoons with great accuracy. These machines are most useful when the B.H.C. must be applied to cane that is too high for other methods or where the absence of open drills or furrows makes it necessary to bury the insecticide.

In treating plant cane in the half-open drill the front wheel of the vibrator should be lowered to raise the share out of the ground. The chute should be loosened so that it will rattle sufficiently to shake the dust downwards. Some growers remove the chute and allow the dust to fall on to the rear wheel, but this will often cause too much scattering and loss in the wind. In one instance an excellent spread was obtained by removing the chute and replacing it with a flat ribbed chute in the shape of a fan, which led the B.H.C. dust towards the stool.

When this type of machine is used for burying B.H.C. the share forms the furrow for the dust and the chute should be loosened as before. Vibrator machines have been coupled in pairs or in sets of four by means of braces across the handles and frames behind the tractor in order to overcome their individual slowness. If one row at a time is normally cultivated there would appear to be little advantage in devising special methods of applying B.H.C. to two rows at a time. The ingenuity would be better engaged in adapting the process of application to coincide with one of the cultivation operations. When twin-row cultivation is practised, however, the application of B.H.C. might well be carried out in the same way.

Attached Distributors.

The mounting of a distributor on a tractor or implement requires the selection of a suitable gear ratio and if a star feed is used some attention must be given to the choice of the star.

The Don Fertilizer Distributor.—The Don fertilizer distributor for attachment to the grubber is adaptable to other mountings. It consists of a wooden hopper on a steel frame which is normally mounted on a grubber and driven by chain and sprocket from the wheel. The feed mechanism is of the star type and is similar in principle to that of the Sunshine machine, described previously. However, they differ in the methods of regulation. If the star is removed it will be seen that the chute is convex inwards where it by-passes the bevelled gear and consequently it obstructs slightly the fall of the material across the portion of the aperture that is uncovered when the control slide is only slightly open. Sometimes, due to rough construction, the obstruction is more than slight. If a light application of B.H.C. is attempted with the slide only slightly open this obstruction may cause trouble. This occurs especially when working down hill, in which case the tipping forward of the hopper brings the obstruction closer to the vertical line of fall. The star provided with Don hoppers is the large type (P32A), which has very high flanged delivery faces. This star, with most normal gear ratios, carries much more B.H.C. dust between the points than is required for the rate of feed, and packing results. The central disc of this type is 3¾ in. in diameter, and is used with a small aperture. It feeds only from the base of the points over the obstructed area. The intermediate and light stars of other manufacturers having central discs 4⅝ in. in diameter may be substituted. These are large enough to cover the obstructed area. The feed from the points is then

unobstructed over a larger area. A D720 type of star delivered 50 to 90 lb. per acre of B.H.C., the higher rate requiring an aperture of nearly 1 in. wide. The writer had no opportunity to calibrate this machine for higher rates such as 150 lb. per acre, but it would appear that a larger star such as a D.1 or a D.838 type would be required, since at 90 lb. per acre the aperture was almost fully open. In adapting stars from other sources it may be found that the driving pin through the star spindle is too low and another hole has to be drilled at least 1/16 in. higher up.

FIG. 13.—A view of a Don hopper on a Farmall tractor.

Another adaptation of this type of distributor is the mounting of two single feed Don hoppers, from cane planters on the implement bar, one on either side, of a Farmall AV tractor between the front and rear wheels. The sprockets and clutch were taken from an old fertilizer cart to drive the hoppers from the tractor rear wheel. The P.32A type of star used in this case was too large and although several methods of adjustment were attempted, better control would have resulted from the use of a smaller star and lower gear ratio. In Fig. 13 is illustrated a Don hopper attached to a Farmall tractor.

Massey-Harris Distributor.—The adaptation of the distributor parts of a Massey-Harris fertilizer cart to a Farmall tractor has been described and illustrated by Humphry (3).

Star Fed Hoppers.—Star fed hoppers are made by International Harvester Company for mounting on certain of their tractor models. The writer is not familiar with the mechanism, which differs in some respects from other types of feed regulation. It is not known whether they have been used for B.H.C., but there seems no reason why they should not be tried.

The Pezzutti Distributor.—Another tractor mounted hopper which has been used to apply B.H.C. but which is also suitable for fertilizer is the "Pezzutti" distributor (Fig. 14). This machine was designed and built in the South Johnstone district. It requires no modification for the application of B.H.C. beyond calibration. It consists of a wooden hopper in which there are two feed apertures 1¼ in. in diameter. The shaft passes through the hopper near the base and above each aperture the shaft takes the form of a worm for a length of about 4 in., and this provides the feeding action. A sliding plate controls the rate of flow by partially closing the apertures. This distributor may be mounted on a wheeled cart or tractor. The mounting on the Farmall AV tractor is made by means of steel arms bolted on the implement bracket inside the hubs of rear wheels of the tractor. The feeding device is driven by a chain from a sprocket on the tractor wheel. A clutch is operated from the tractor seat.

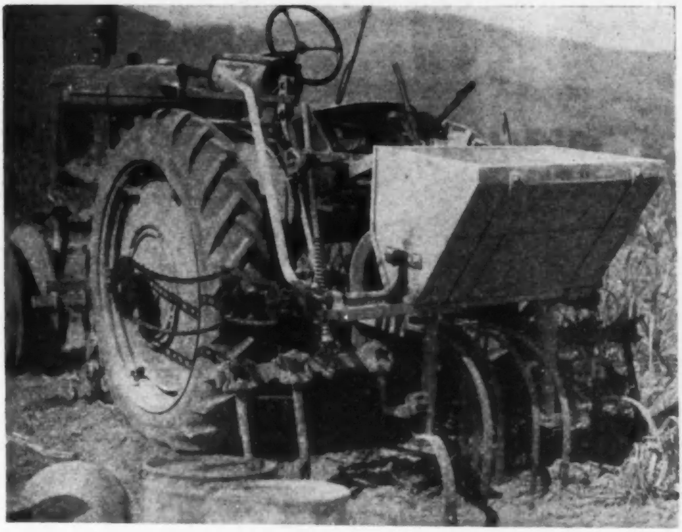

Fig. 14.—A view of the Pezzutti distributor.

For 80 lb. of B.H.C. per acre the aperture is less than a quarter open and for lower rates a slower gear ratio would be an advantage. This distributor has also been attached to a Holt tractor for use on red volcanic hilly fields; but in this case a considerable alteration in the gearing was required for the smaller diameter driving wheel.

The Hodge Conical Hopper.—The Hodge conical fertilizer hopper is easily mounted on a tractor or implement for the application of B.H.C. An arrangement in which two of these were mounted on ratooning ploughs was described and illustrated by Bates (1). For plant cane a pair of hoppers of this type may be fitted on the tractor pole of the cotton king. The standard land wheel drive of the Hodge hopper is used and a lever is mounted at the front of the pole within

reach of the tractor driver. The hand lever may be used to raise the wheels off the ground to stop the flow of B.H.C. Care should be taken to see that the regulating slide is inserted in the hopper so that the feed aperture is open for the downward stroke of the feed butterfly. The regulating slide is held in place by a piece of inner car tubing about a foot long with a slit cut on one side to fit over the end of the regulating slide. The other side of the tubing exerts a pull on the regulating set-screw and holds the slide at its proper setting. The rubber tube also acts as a wind break and its natural curve may be used to direct the flow of B.H.C. towards the stool. The Hodge hopper should not be

Fig. 15.—Illustrating the use of Hodge hoppers with two cotton kings.

overfilled as in humid weather cavities may form in the dust around the butterfly. Filling the hopper to one-third of its depth has been found safe practice. The band of B.H.C. falls in front of the disc nearer the cane and the discs move it towards the cane and cover it. If the spread is not satisfactory it may be improved by dragging a short piece of very heavy chain or other device below and behind the hopper but in front of the discs. For applications to ratoons another cotton king is attached to the tractor and set to cut away from the stool. The implement carrying the Hodge hoppers is attached behind this and set to cover in the furrow. Such an arrangement is illustrated in Fig. 15.

One cane grower whose farm contained very loose sandy soil on which the use of a distributor with an extended axle was imperative fitted two Hodge hoppers to a wiggle-tail cultivator. The drive was provided from the cultivator axle by means of a sprocket and chain. This arrangement is illustrated in Fig. 16. The axle permitted an extension to about 5 ft. 6 in. only which was insufficient to stabilise the machine if driven in the ordinary way. The right hand wheel was allowed to drop into the drill and this gave stability of alignment. The other wheel ran in the interspace. The cultivating and distributing gear were offset to the left so that they were directly over the drill being treated.

Hodge hoppers have also been mounted in pairs on the tractor and chain driven. In one example a bar of square steel was attached below the crank case of a Farmall AV about 9 in. in front of the rear wheels. The hoppers were bolted to this, one on either side of the tractor. A solid shaft was extended through the two hoppers and was driven by a chain from a sprocket fitted to one wheel of the tractor. The slow feed was probably an advantage as it permitted a larger aperture, and

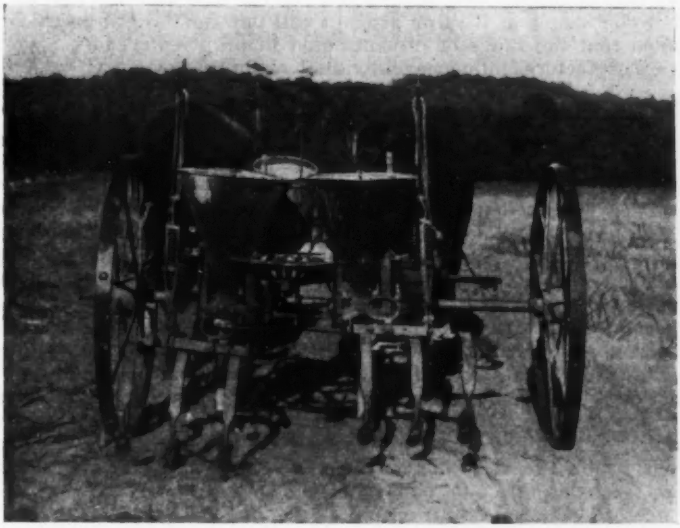

FIG. 16.—Showing two Hodge hoppers fitted to a wiggle-tail cultivator.

the rate of delivery was ample since two hoppers were being used. The operator applied 5 cwt. of fertilizer per acre and considered that with full aperture 8 cwt. could be applied, while 100 lb. per acre of B.H.C. dust was applied with a big reserve of capacity. A straight bracket about 18 in. long was bolted to the front edge of each mudguard, and on these were pivoted handles, so that the operator could alter the slides for turning at the end of a row, without leaving his seat. Since the slides were too close to the wheels for this to be worked in their original position the two halves of the feed casting were separated and two new holes bored for the connecting studs in the lower portion so that the hopper was turned through an angle of about 30 degrees with respect to the lower portion. The slides then protruded inwards towards the tractor seat. No clutch was fitted and it is perhaps fortunate that this machine was used in a very dry period, otherwise the rotation of the butterflies while the slides were closed might have caused packing. Disturbance of the material in the bottom of the hopper when required, was effected by placing in each a piece of $\frac{1}{2}$ in. pipe split at the bottom and in the form of a "Y" or with a cross piece welded on to prevent it dropping into the feed mechanism.

Another grower using a Farmall tractor with wheels extended for two-row cultivation attached the hoppers on the upper implement brackets and placed the driving sprocket on the tractor axle inside the wheel.

Calibration.

The cane grower who uses B.H.C. would be wise to provide himself with a set of scales for weighing up to 28 lb. to the nearest ounce so that he may calibrate his distributor. If the area covered by an 80 or 112 lb. bag of B.H.C. dust is used as a basis of measurement the material liable to be wasted at the first attempt will pay for the scales. It should be noted that the range of diluents used in proprietary dusts, together with other factors, influence individual calibrations.

The first step in calibrating a machine is to collect and weigh the B.H.C. delivered while it travels a known distance, preferably one or two chains. If the driving wheel can be jacked up it may be revolved the number of times equivalent to such a distance and the material collected. This is done for various settings of the regulating device. For instance, a wheel 4 ft. in diameter will turn 5¼ times in one chain; the 16 in. diameter land wheel of the Hodge hopper will turn nearly 16 times in one chain. Eleven oz. of material delivered in that distance represents a rate of 100 lb. per acre. As up to 10 per cent. wheel slip may occur with various machines it is best to allow for this in the calibration. The calibration is then checked in the field. Enough B.H.C. dust to treat, say, 10 to 20 chains is weighed and put into the hopper and the distance required to use this quantity is measured. A correction should be made if necessary. If there is much dead space around the feeding mechanism it is a good plan to fill the hopper to a predetermined mark with B.H.C. dust. For instance, it may be filled to the top of the star or to the level of some other part of the mechanism. The weighed material is put on top of this and its level should coincide with the original level when the required distance has been run.

If the operator has had no previous experience with B.H.C. dust and he strikes a batch that is damp or contains much foreign material he will have difficulty with the calibration and subsequent operation of the machine. He should therefore examine the contents of several containers and make himself familiar with the material and watch for signs of undue clamminess and the presence of string, stones, &c. The writer has seen B.H.C. dust, after exposure to a moist wind in an open shed, flow at less than 50 lb. per acre from a Mourilyan machine set to deliver at least 200 lb. per acre. The dust was tipped out on a sheet in the sun while the machine was cleaned out. After refilling the machine the dust had improved sufficiently to flow at 80 lb. per acre at a setting appropriate to about 130 lb. per acre. Damp material may be dried appreciably on a sunny day by sieving it into the hopper of the machine, but some adjustment to the control will be required from bag to bag.

Sieving.

As B.H.C. dust from any source is liable to contain foreign matter it may be found necessary to sieve the dust. A sand sieve of not too fine a mesh or a piece of ¼ in. fugal gauze are satisfactory.

While the lubrication of agricultural implements is an everyday procedure it has special aspects when in the proximity of B.H.C. dust. Dry cleanliness is a first essential in the feed mechanism and a lubricant should not be used where it is likely to seep along a shaft into the hopper near the moving dust. In star fed machines, however, it may be used underneath the star where the bevelled gear rotates in the base plate. If the machine is idle for a few days with this part unprotected it will sieze with rust caused by the B.H.C. and a breakage will occur when the machine is restarted. The drive chains are almost invariably bombarded with loose soil from the drive wheel which, with lubricant, forms a cutting paste. The gain in cleanliness and convenience by leaving these chains dry more than compensates for any wear caused by a lack of lubricant.

Wind Effect.

A most important precaution, and one not sufficiently observed in many cases, is the prevention of loss of B.H.C. by windage at the point of delivery. Hessian guards may be provided, even on small machines, and adapted to the field contour.

Summary.

The application of B.H.C. dust to sugar cane fields for grub control has increased rapidly since its inception in 1947, so that now many thousands of acres are treated and there is a growing demand for machines that will distribute it accurately.

The insecticide may be applied in the field by means of a wide variety of existing fertilizer distributors or by specially designed machines. A survey of the types available and their suitability for different conditions are discussed. Modifications of fertilizer distributors to adapt them to the accurate application of B.H.C. dust are suggested.

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A Trailer for Cane Haulage.

BY H. G. KNUST.

SEVERAL forms of cane haulage from the field to the loading point or delivery point are in use in the Bundaberg district. Transport methods commonly used are portable line from the field to the main tramline and by motor lorry. Much of the haulage by motor lorry is done by contract, but increasing charges for the work and inability of some contractors to cope with the large volume of work have forced some growers to haul their own cane per medium of a strongly constructed trailer (Fig. 17) which is attached to the drawbar of the tractor. Transferring the loaded trucks from the trailer to the main tramline requires very little time and effort. The trailer is hauled astride the tramline

FIG. 17.—Empty cane truck loaded on trailer and ready for return trip to field.

where the wheels come to rest in depressions made for the purpose; the rear end of the trailer then rests lightly on the tramline and provides stability for unloading. A set of specially made rails is fitted behind the rails on the trailer and on top of the tramline and the loaded truck lowered with an 18 ft. length of ½-inch steel rope attached to a hand-operated winch on the front of the trailer (Fig. 18). The empty truck is then hauled on to the trailer (Fig. 19) for the return trip to the field.

Growers at present using this form of transport find it is less costly than the contract method of carting, the cost per ton varying from 2s. to 2s. 6d. according to the distance hauled.

Fig. 18.—Loaded truck being lowered from trailer on to tramline.

Fig. 19.—Cane truck on trailer standing in field ready for loading.

The trailer can be made by the average grower at a cost of a few pounds and besides being used for cane haulage is also useful for hauling fertilizer and other heavy material about the farm. Timber should be rough hardwood; steel brackets and drawbar should be made of 2 inch by ½ inch steel, and wheels are fitted with pneumatic tyres 32 x 6.

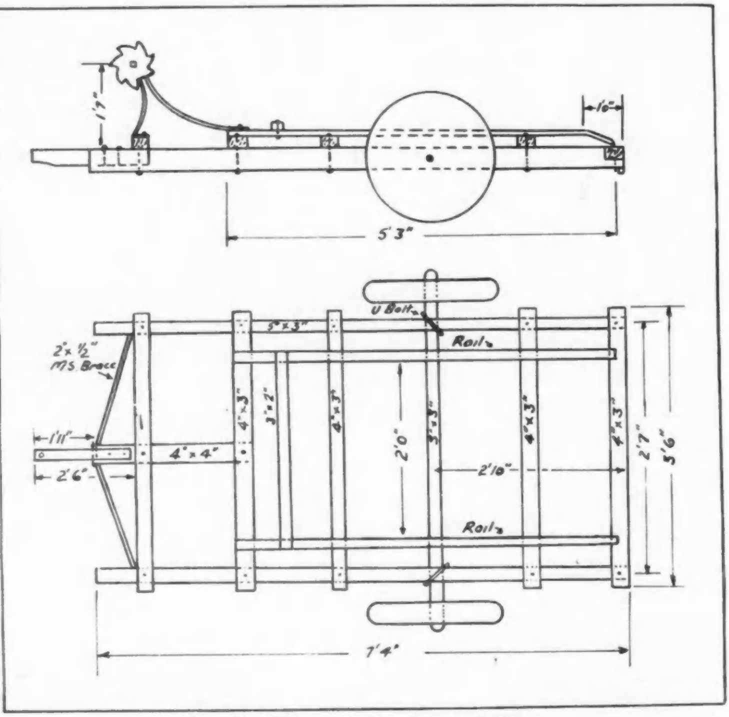

FIG. 20.—Plan and elevation of trailer.

The rails for unloading are 6 feet long, slightly bent downwards on the ends which fit on the trailer, and tapered on the ends which sit on the main tramline. Two flat sleepers 1½ inches by ½ inch are fitted 3 feet 2 inches apart with the first one 10 inches from the tapered end. The sleepers are folded over the outer base of the rail and bolted to the inner base. The sketch (Fig. 20) should provide the necessary information for growers desirous of constructing their own trailers.

Downy Mildew Disease in North Queensland.*

BY C. G. HUGHES.

Introduction.

A PAPER on downy mildew disease at this Cairns Conference might be considered out of place when the district as a whole has not been worried by the disease for six or seven years. It is true that the disease had not appeared in commercial crops for some time and that a large proportion of the varieties grown at the various northern mills are susceptible. However, an outbreak of the disease at White Rock near Cairns during the summer of 1949 indicated that the disease had not been eradicated and that a very close watch for it would have to be kept for some years. There is a real risk that the disease may reappear somewhere in the district, and should it do so the losses it could cause in the susceptible Trojan and the very susceptible Eros would be very serious.

History of the Disease in North Queensland.

The country in which downy mildew disease of sugar cane originated has not been determined, but it seems possible that downy mildew was introduced into Australia from New Guinea in the 1890's. It would appear that a variety named "Violet" had to be abandoned in the Herbert River district in 1901 on account of the ravages of the disease, and by 1910 it was present in a number of areas in Queensland. Within the next few years it was reported in the Cairns, Johnstone, Herbert and Mackay districts, and as far south as Bundaberg. Incidentally the disease has never occurred south of Bundaberg. In 1929 it was so widespread in the North that it occurred wherever susceptible varieties were grown. The varieties then showing the disease included B.147, B.208, Pompey and several minor, susceptible canes.

With the organization of the Pathology Division of the Bureau and the institution of the Cane Pest and Disease Control Boards in the next few years the problem of downy mildew in the North was tackled in earnest. Roguing gangs were organized, badly diseased fields were ploughed out, susceptible varieties were eliminated from the diseased localities, corn was prohibited in the danger areas and sources of clean plants were arranged. Within a few years the disease survived only in small pockets at Mossman, Hambledon and Mulgrave. Continued control measures have reduced the incidence of disease and, with the exception of the outbreak at Hambledon, which is to be discussed in this paper, the only diseased stools found in recent years were at Mulgrave and Hambledon in 1943 and at Mossman in 1946.

This brief, simple statement on the control of the disease is not meant to convey the impression that it was an easy victory. Pest Board officers will know that it was not, despite the fact that the activities

* Paper presented at the Cairns Conference Q.S.S.C.T., April, 1950.

were in areas surrounded by reasonably resistant varieties and were not hampered by extensive commercial plantings of susceptible canes. It is likely that with the changed varietal position in the last few years, a serious outbreak of downy mildew could not be brought under control without the discarding of at least one valuable variety. It was fortunate that the disease was brought under control because its presence would have seriously interfered with the propagation of the susceptible Trojan and Eros in North Queensland. It is certain that these varieties could not have been distributed had downy mildew still been present.

The Recent Outbreak at Hambledon.

The outbreak at White Rock, which has again focussed attention on this disease, was discovered at the end of January, 1949, in a block of first ratoon Trojan forming part of a 16.9 acre field. Only three stools were found on the first day, but regular inspections were immediately instituted. Six inspections were made within the next four weeks and by then 52 stools had been rogued, despite the fact that all diseased stools were dug out immediately they were found. The disease had spread to other points in the field and aided by the hot, steamy weather, which made the inspecting work very arduous, threatened to spread into adjacent fields. Inspections of the diseased and neighbouring blocks were then made every working day, and although several diseased stools were found in two blocks of Trojan on an adjoining farm it did appear that the outbreak was under control by the second week in April. One stool was found at the end of May, but none has been found since. As the diseased blocks have been ploughed out and plants for neighbouring blocks have been brought from clean, disease-free areas it is hoped that the disease has been eradicated. Altogether less than 100 stools were rogued, but this is not a good measure of the seriousness of the outbreak. A few stools in the area of 54 acres involved was a negligible loss, but the potentiality for loss in Trojan and Eros was so great that the most energetic control measures were called for. It is a tribute to the inspectors that the outbreak was brought under control before widespread infection had caused heavy losses.

The origin of the outbreak is unknown. The disease was present on neighbouring farms in 1942 and 1943, but the infected fields were ploughed out and not a single diseased stool was seen during the intervening years. It seems unlikely that the disease persisted in commercial crops because the varieties grown on these farms for the past few years were susceptible to the disease and would no doubt have suffered severely from it. The number of diseased stools and their disposition in this outbreak indicates that the source of infection had very recently arisen. It may have come from spores of the disease-causing fungus in the soil although such a happening has never been recorded, or some host plant other than cane may have kept the disease in existence over the years. Corn and sorghum and probably Johnson and Sudan grasses are able to harbour the fungus, and it is possible that the disease persisted in one of these species after it had been eradicated from the cane crops.

Whatever the cause of the outbreak, its occurrence serves to emphasize the importance both of keeping a constant watch even in apparently healthy districts and of having up-to-date knowledge concerning the disease reactions of all varieties grown on a commercial scale.

Chief Features of the Disease.

In order that farmers may be able to recognize the disease in their crops a brief description of the chief symptoms is included.

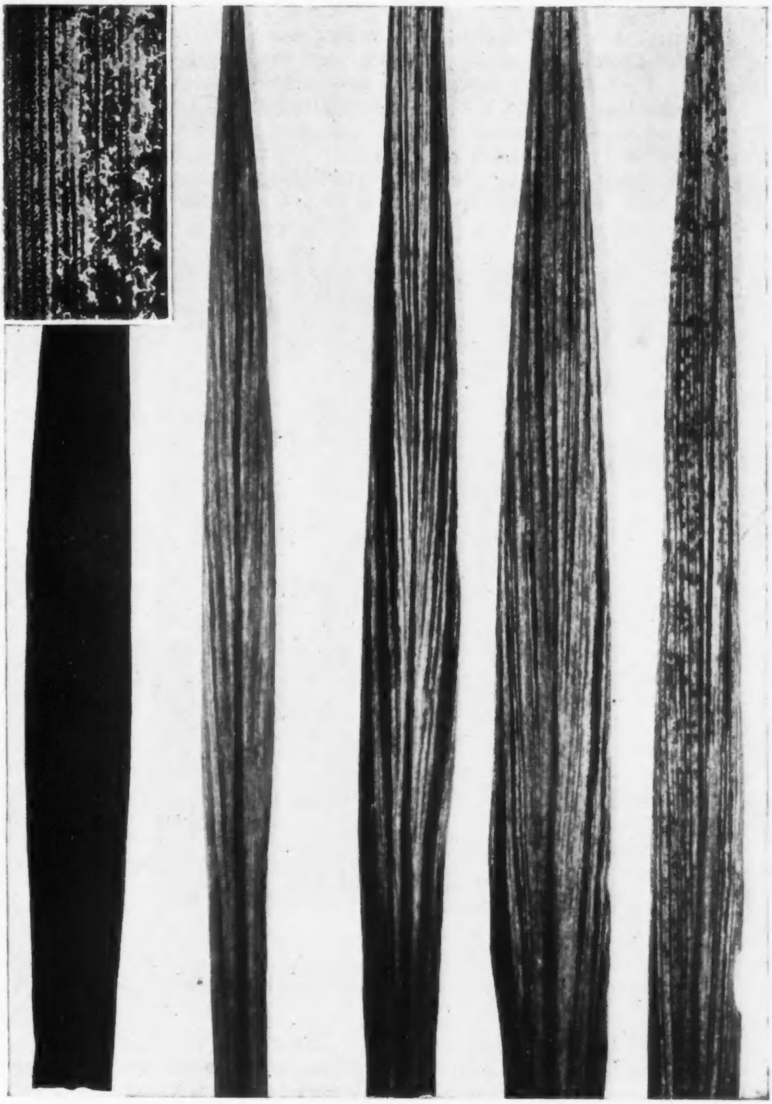

FIG. 21.—Leaves of variety P.O.J. 2878 showing typical leaf streaks. The leaf on the extreme left is healthy.

INSET.—Appearance of "mildew" on under surface of leaf (magnified).

Symptoms are of two types:—

1. The leaf streaks or striping.
2. The "jump-up" stage.

The first type is the more common and shows most prominently during periods of rapid growth in warm, moist weather. The streaks are greenish-yellow in colour and run with the length of the leaf (see Fig. 21). They vary in length from a few inches to almost the full length of the leaf-blade and are 1/25 to 1/5 in. in width. They may be spread over the whole leaf-blade or only on part and in the young leaves are more obvious towards the base. As the streaks age they change to a more definite yellow, then to mottled reddish brown, and finally to a uniform dark red colour. By the time this stage is reached, practically

FIG. 22.—Illustrating the elongation of stalks ("jump-up") and sparse leaf development characteristic of the oospore stage of the fungus.

all leaves on the one stalk will be affected and a general discolouration of the top results. The diseased stick may be stunted and thin or, if infection occurs late in the life of the stick, the leaf streaks on the leaves of the main top or of a side-bud which has shot may be the only indication of the disease. The young discoloured shoots arising from diseased setts or as ratoons from diseased stools are very obvious.

Under favourable conditions of warmth, moisture and still air the development of the leaf streaks is accompanied by the nocturnal production of a fine white mildew. When seen early in the morning before the dew has gone it has a soft, velvety appearance and is off-white in colour. Under the microscope the mildew is seen to consist of a mass of white threads which produce myriads of tiny spores. These serve to spread the disease from plant to plant in the field. They are thin-walled and delicate and so are very sensitive to sunlight or a drying atmosphere. At night, however, when the humidity is high and the air currents slight, the light spores may drift considerable distances and set up new infections. It is advisable therefore not to take setts for planting from a field within half-a-mile of the nearest known disease.

The second type of symptom is found in the winter, but only when plants have been diseased for some months. It consists of an elongation of certain stalks in diseased stools, with the result that the sparse, diseased top is pushed above the general level of the field to give the characteristic "jump-up" (see Fig. 22). This expressive term was introduced by the Kanakas. Leaves in the jump-up frequently shred and twist, due to the development of a second type of spore in the leaf. These spores are large and thick-walled and are not designed for transport by breezes but are reputed to be resistant to adverse conditions. It is possible that they may persist in the soil for some time, but nobody has yet been able to germinate them or to start an infection from them so their importance in the spread of the disease is not known.

Control.

The control of a disease such as downy mildew needs the close co-operation of farmers, Boards and Bureau. Firstly, it must not be re-introduced from a known diseased area. The disease still occurs in part of the Bundaberg district, and quarantine restrictions imposed by the Sugar Experiment Stations Acts are aimed at the prevention of movement of any cane plants from this area. Secondly, should the disease occur in a district the strictest control measures should immediately be brought into effect. Downy mildew disease in an area where a large proportion of the crop consists of susceptible varieties may be dangerous and should be handled with the greatest caution. If it were allowed to become established district-wide losses could occur. The first step in an attack against a small focus of infection such as that which occurred at Hambledon is the roguing of the diseased stools. At the same time arrangements should be made for the early harvest and ploughing out (with a bare fallow afterwards) of the diseased fields. In addition susceptible varieties should not be planted within half-a-mile of the known site of the disease and no plants of any variety should be taken from the diseased fields or from any within the half-mile from them.

The degree of resistance of commercial varieties may be the most important factor in campaigns to control the disease, and while susceptible varieties may be grown when the disease is not a threat, it is advisable always to have a number of resistant varieties in reserve, as it were, in case there should be an outbreak. The reaction to downy mildew of the varieties on the approved list for mills north of Townsville is set out in Appendix I.

APPENDIX I.

Variety.	Reaction to Downy Mildew Disease.	Variety.	Reaction to Downy Mildew Disease.
Badila	Resistant	P.O.J.2725 ..	Resistant
Badila Seedling ..	Resistant	P.O.J.2878 ..	Very susceptible
Cato	Resistant	Pompey ..	Susceptible
Clark's Seedling ..	Resistant	Q.2	Susceptible
Comus	Resistant	Q.10 ..	Moderately resistant
D.1135	Susceptible	Q.20 ..	Resistant
Endor	Insufficient information	Q.44 ..	Resistant
Eros	Extremely susceptible	Q.50 ..	Moderately resistant
H.Q.409	Moderately resistant ..	S.J.2 ..	Highly resistant
Korpi	Resistant	S.J.4 ..	Resistant
Orion	Resistant	Trojan ..	Very susceptible
Pindar	Resistant		

THE DISEASE RESISTANCE OF APPROVED CANE VARIETIES.

Within recent weeks a Table showing the resistance to the major diseases of all varieties appearing on the approved lists has been sent to the various Cane Pest and Disease Control Boards in Queensland. It has created a good deal of interest and the Bureau has been requested to give it a wider circulation. It is therefore being published here so that every cane grower may have a copy.

The information contained in the Table has been gathered from observations in the field extending over many years as well as from the results of the disease resistance trials which form such an important part of the work of the Bureau pathologists. (See article "Testing Sugar Cane Varieties for Resistance to Disease" in this issue.) It will be noted that there are occasional gaps in the Table, particularly in relation to newer varieties; these are however being attended to and in most instances the varieties concerned are included in resistance trials which are now current. Results from these will be available later in the year.

C.G.H.

TABLE SHOWING DISEASE RESISTANCE OF APPROVED VARIETIES, 1950.

Variety.	Red Rot.	Fiji.	Downy Mildew.	Leaf Scald.	Gumming.	Top Rot.	Chlorotic Streak.	Mosaic.
Atlas	1	1–2	1	1	1	..	..	1
Badila	1	2	1–2	2	2	2–3	2–3	2
Badila Seedling (Bab)	..	..	..	..	2	2–3	2	..
Badila Seedling (Innis)	..	..	..	..	2	2–3	..	..
B.208	1	3 ?	4	..	3	1	..	3
C.P.29/116 ..	1	2	1	1	1	..	2–3	1
Cato	..	..	1–2	2	2	2 ?	..	..
Clark's Seedling ..	1	3	1	3	3	1	2–3	3
Co.290	3	1	2	..	1	2	1	2
Co.301	..	1	1	..	..	..	..	2–3
Comus	1	2–3	1	1	1	1	..	3
D.1135	1	3	2–3	1	2–3	1	..	2–3
E.K.28	1	3	2	3	3	1	3	2
Eros	1	2	4	1	1	2	2–3	..
H.Q.285	..	1–2	..	..	3	..	..	3
H.Q.409	1	..	2	2	1–2	1	..	..
Korpi	1	2	1–2	2	1	1–2	3	2–3
M.1900 Seedling ..	1	3	1	2	3	2–3	..	2–3
Mahona	..	2	2–3	4	3	..	..	2
Oramboo	1	2	1–2	4	1	..	..	3
Orion	..	..	1	3	1	..	3	..
Pindar	..	..	1	1	1	..	2–3	2 ?
Pompey	..	..	2–3	2	2–3	1	3	2
P.O.J.213 ..	..	1	3	1	1	1	1	3
P.O.J.2714 ..	..	4	3	2	3	4	..	1–2
P.O.J.2725 ..	1	3	1–2	1	1	1	3	1
P.O.J.2878 ..	2	3	3	1	1	4	3	1
Q.10	..	2–3 ?	2 ?	2	1–2	1	2–3	2–3
Q.25	..	4	1–2	..	1	..	..	3
Q.28	2	1	1–2	..	1	..	2–3	2
Q.42	1	2	1	..	2	..	1–2 ?	3
Q.44	..	1	2	3	1	1	2	..
Q.45	1	3	2 ?	..	1	1	..	1
Q.47	1	1–2	1–2	..	1	1 ?	2–3	1–2
Q.48	..	1–2	2	..	1	3	..	..
Q.49	2–3	2–3	2	..	1	2–3	3	2–3
Q.50	3	..	2–3 ?	1	1	1	1	2–3
Q.51	..	2	2	..	1	3	..	..
Q.813	..	1–2	1–2	1	1	1	1–2	1–2
S.J.2	..	..	1	4	3	..	..	2–3
S.J.4	..	..	1–2	2	4	2	2–3	2–3
S.J.16	..	..	3	..	2	3	..	..
Trojan	1	1	3	2–3	1	1	2–3	2–3
Vesta	2	1–2	3	..	1	1	3	1

KEY.

1 = Highly resistant; may be grown in the presence of disease without precautions.

1–2 = Resistant.

2 = Intermediate; may be grown in the presence of the disease provided suitable precautions are taken.

2–3 = Susceptible.

3 = Highly susceptible; can only be grown when particular precautions are taken.

4 = Extremely susceptible; cannot normally be grown in the presence of the disease.

PROCEDURE FOR TAKING SOIL SAMPLES.

Owing to differences in the fertility gradients of soil in different parts of a field, it is sometimes a difficult matter to obtain a sample which will truly represent the block of land under investigation and single samples taken at random are practically worthless. A number of sub-samples from different parts of the field under examination must therefore be taken and approximately equal weights of each mixed thoroughly to form the final sample. The number of sub-samples which should be taken and mixed to obtain such a representative sample will depend on the apparent variability of the soil but at least three samples should be taken and composited for the smallest area. For areas of 5 to 10 acres at least two samples per acre should be taken and composited.

One of the most convenient implements with which to sample the soil is a post hole digger, as this removes a complete portion in one operation. An ordinary 1½-inch auger is good, provided the soil is sufficiently moist to cling to it firmly. If these implements are not available, a square hole should be dug to a depth of 10 inches, and after cleaning out the loose earth, a slice about 2 inches to 3 inches thick taken down one side of the hole from top to bottom. Such a sub-sample should then be placed on a bag or piece of canvas. Other sub-samples (of approximately similar weights) should be taken and added to the first one on the canvas and all mixed thoroughly before making the final sample, which should approximate two pounds.

Soils which appear markedly different must never be mixed, but each sampled for separate analysis. To obtain the most useful information from the analysis of the soil, it is necessary to take the sample just before or just after a cane crop is harvested and before the fertilizer is applied to the next crop. Samples should be taken from the space between the rows where there is less likelihood of contamination occurring from a previous application of fertilizer. Fallow blocks should not be sampled since the results do not always give a true indication of the immediate fertilizer requirement.

Samples should be forwarded to the Director, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock, William Street, Brisbane, and should be carefully marked. A letter should accompany all samples supplying information and details regarding the following:—

Farmer's name and address;

Drainage (good, bad, &c.);

Surface soil (sandy, red volcanic, &c.);

Subsoil (heavy clay, sandy, &c.);

Class of crop now on field (Q.50 plant, &c.);

Is green manuring practised?

Usual fertilizer treatment;

Has soil been limed?

Reasons why analysis is required.

L.G.V.

A. H. Tucker, Government Printer, Brisbane.